

WHAT IS CLAIMED IS:

1. A cooling assembly comprising:
an electronic package having a cavity;
at least one die with active electronic components located in the cavity;
and
at least one coolant port that allows a coolant to enter the cavity and directly cool the active electronic components of each die.
2. The cooling assembly of claim 1, wherein the package further includes compliant interconnects within the cavity, and the compliant interconnects are coupled between each die and the package.
3. The cooling assembly of claim 2, wherein said compliant interconnects comprise spring contacts.
4. The cooling assembly of claim 3, wherein said spring contacts comprise wirebond springs.
5. The cooling assembly of claim 3, wherein said spring contacts comprise lithographic springs.
6. The cooling assembly of claim 5, wherein said lithographic springs comprise multipart lithographic springs.
7. The cooling assembly of claim 2, wherein each die has at least one active surface, and when the coolant circulates in the cavity the coolant directly cools each active surface of each die.

8. The cooling assembly of claim 2, wherein each die has a plurality of surfaces within the cavity including at least one active surface associated with respective active electronic components, and when the coolant circulates in the cavity the coolant directly cools each surface of each die, thereby reducing thermal gradients or hot spots on each active surface of each die and increasing the operating range of each die.
9. The cooling assembly of claim 2, wherein the at least one coolant port allows liquid coolant to enter and exit the package.
10. The cooling assembly of claim 2, wherein the at least one coolant port allows gas coolant to enter and exit the package.
11. The cooling assembly of claim 2, wherein the at least one coolant port allows a combination of liquid and gas coolants to enter and exit the package.
12. The cooling assembly of claim 2, wherein the at least one coolant port comprises a valve that allows the coolant to enter the package and surround each die.
13. The cooling assembly of claim 2, further comprising:
 - a cooling system; and
 - a coolant circulation system coupled between the cooling system and the at least one coolant port.
14. The cooling assembly of claim 2, wherein said package further comprises:
 - bottom and top substrates coupled to one another by a seal to form a cavity enclosing each die.
15. The cooling assembly of claim 12, wherein the seal comprises an O-ring.

16. The cooling assembly of claim 2, wherein said package further comprises: a bottom substrate on one side of the cavity, wherein each die with active electronic components is connected to the bottom substrate by the compliant interconnects, and wherein the active electronic components face the bottom substrate and contact coolant surrounding the compliant interconnects within the cavity.

17. The cooling assembly of claim 16, wherein said compliant interconnects comprise first and second sets of compliant interconnects, and wherein said package further comprises a top substrate; and

further comprising alignment posts, wherein the alignment posts are attached to the bottom substrate, the first set of compliant interconnects is coupled between each die and the bottom substrate, and the dies are further held in place by contact with the alignment posts and downward pressure from the second set of compliant interconnects.

18. The cooling assembly of claim 2, wherein said package further comprises a bottom substrate having contacts, whereby external components can be electrically coupled to each die via the contacts.

19. The cooling assembly of claim 2, wherein said package further comprises a bottom substrate having contacts arranged on an edge region of the bottom substrate, whereby external components can be electrically coupled to each die via the contacts.

20. The cooling assembly of claim 2, wherein said package further comprises a top substrate with a top surface representing an exterior surface of the package and wherein the top surface includes contacts, whereby external components can be electrically coupled to each die via the contacts.

21. The cooling assembly of claim 2, wherein said package further comprises:
 - a top substrate;
 - a bottom substrate; and further comprising:
 - interconnection elements that provide electrical paths extending through the top substrate and the bottom substrate.
22. The cooling assembly of claim 2, wherein said at least one coolant port allows a coolant to enter the cavity in a liquid form and exit the cavity in a gas form to directly cool the active electronic components of the dies, and wherein said coolant has a boiling point at or near an operating temperature of each die.
23. The cooling assembly of claim 2, further comprising:
 - a coolant circulation system coupled to said at least one coolant port, wherein the coolant circulates within the package and directly contacts all surfaces of each die to directly cool active electronic components during their operation.
24. The cooling assembly of claim 2, further comprising:
 - a cooling member; and
 - one or more heat radiators, wherein each die is immersed in the coolant and each heat radiator transfers heat generated by each die from the coolant to said cooling member.
25. The cooling assembly of claim 2, further comprising at least one non-contacting compliant interconnect coupled to a surface of said at least one die, whereby, heat can be further directed away from the surface of a die.
26. The cooling assembly of claim 2, wherein said package further comprises:
 - a top substrate; and

a bottom substrate; wherein each die is flip-chip bonded to said top substrate.

27. A method for direct cooling of active electronic components, comprising:
coupling active electronic components through compliant interconnects to a substrate of a package such that the active electronic components face the substrate;

sealing the attached active electronic components and compliant interconnects within a cavity of the package;

and

circulating coolant through the package cavity to directly contact the active electronic components.

28. A cooling assembly, comprising:

means for sealing at least one die with active electronic components in a package; and

means for circulating coolant through the package during operation of the active electronic components to reduce thermal variations across each die.